

Mesh Independent Probabilistic Residual Life Prediction of Metallic Airframe Structures, Phase I

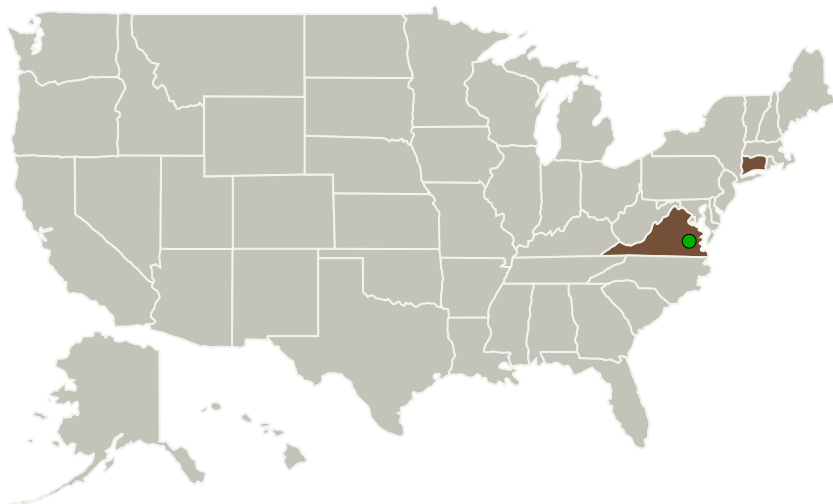
Completed Technology Project (2011 - 2011)



Project Introduction

Global Engineering and Materials, Inc. (GEM) along with its team members, Clarkson University and LM Aero, propose to develop a mesh independent probabilistic residual life prediction tool for metallic airframe structures. The deterministic solver of this probabilistic analysis tool will be developed by integrating our cutting edge extended finite element toolkit for Abaqus (XFA) with a novel small time-scale fatigue crack growth model for mesh independent fatigue crack growth prediction of a complex airframe structural component subjected to multiaxial and variable amplitude loading. The fast matching and narrow band technique will be implemented to track a curvilinear 3D crack growth without remeshing. Both the versatility and the high computational efficiency will make the XFA an ideal solution model for the probabilistic life prediction where the initial defect shape and location can be treated as random variables without user intervention. After the integration of XFA with a general purpose probabilistic analysis framework (PFA), the resulting probabilistic version of the XFA (PXFA) will enable the following: 1) fatigue reliability assessment of an aging component; 2) evaluation of design variables to meet a targeted reliability level; and 3) provision of operational decision support using SHM data on repair, maintenance, and life extension options.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Global Engineering and Materials, Inc	Lead Organization	Industry	East Lyme, Connecticut
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Connecticut	Virginia

Project Transitions

 **February 2011:** Project Start

 **September 2011:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138295>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Global Engineering and Materials, Inc

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Yuanjie Lua

Co-Investigator:

Jim Lua

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Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.1 Materials
 - └ TX12.1.2 Computational Materials

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System